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VIA FACSIMILE **CONFIDENTIAL**

Joseph R. Magnone, Esq.
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P. O. Box 1404
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RE: PM 1719 Ceramic Heater

Dear Joe:

Confirming recent telecons, please prepare on an expedited basis a patent application on the above-identified disclosure.

The following synopsis should assist you in resolving the subject matter.

The Beta lighter requires a conductive ceramic material which has low density, a resistivity of about 10^{-2} to 10^{-3} ohm per cm, oxidation resistance at or above 800-1000°C and a high melting point.

The enclosed page 1 shows details of a heater fixture which employs a ceramic heater component. An alternate (monolithic) heater embodiment has a shape similar to the aforementioned ceramic heater component of the first embodiment, but with metallic (platinum or gold) coatings at the blade tips and hub for establishing electrical connections. The monolithic embodiment is operable without the fixtures of the first embodiment.

The enclosed page 2 sets forth the currently preferred mixture of ceramic starting materials. The formulation arises from the following considerations:

(a) volume percent of conductive material: in reference to the chart on the enclosed page 3, the proportion of conductive material is selected so that a small change in the proportions does not precipitate a huge change in resistivity. TiC and $MoSi_2$ are metallic conductors, Si_3N_4 is an insulator, and please note the ratio in the current proportions of Si_3N_4 to $MoSi_2$ and how such relates to the relationship shown on the enclosed page 3;

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(b) temperature coefficient of resistivity: SiC has a negative temperature coefficient of resistance (resistance drops as temperature increases). $MoSi_2$ has a positive one (resistance increases with temperature), these two components are proportioned to provide a relatively fixed resistance throughout the heating cycle;

(c) oxidation resistance: Si_3N_4, SiC and $MoSi_2$ are oxidation resistant; TiC is not. Si_3N_4, SiC and $MoSi_2$ will form an adhered silica layer along the surfaces of the heater;

(d) low density: a lower density material requires less energy to obtain the same maximum temperature during a resistive heating cycle. The selection and proportion of ceramic starting materials and the processing thereof achieve a workable final density;

(e) low dissociation vapor pressures.

A triple component formula and a dual component formula are set forth at the bottom of the enclosed page 2.

Processes include:

(a) injection molding: (1) mix powdered ceramic components together along with binders and plasticizers; (2) injection mold at 250°C; (3) pre-sinter to 1000 to 1200°C to produce a green, pre-formed, machinable piece, whose binder and plasticizer have been driven-off; (4) machine to final shape; and (5) HIP to the final density (at 1700-1800°C, 150-250 mega Pascals);

(b) cold-isostatic pressing: (1) slip cast a tube of powdered ceramic material using cold isostatic pressing techniques (no binders); (2) apply pressure three-dimensionally to obtain a rod; (3) pre-sinter; (4) machine to final form; (5) sinter again to full density; and

(c) high temperature extrusion: (1) extruding a continuous rod of ceramic material at about 1300-1700 degrees Celcius; and (2) cutting and grinding at spaced locations along the rod to a final shape (see the enclosed pages 4 and 5).

Please give the materials science aspects of the disclosure your greatest attention during the preparation of the application.

Thank you for your immediate attention to this matter.

Very truly yours,

Charles E. B. Glenn

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Enclosure

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